CANADA COMMUNICABLE DISEASE REPORT

CCDR SUPPLEMENT

June 18, 2015 • Volume 41 S•4

ISSN 1481–8531

Inside this supplement: Antimicrobial stewardship

Stewardship is the responsible planning and management of resources and has been aptly applied to antimicrobials to prevent and moderate the development of resistance. In this supplement, read about some successful stewardship programs designed to moderate public demand and physician prescribing, and the importance of adopting a culture of stewardship across Canada. Stewardship is one of the three pillars of Canada's Federal Action Plan on Antimicrobial Resistance, and is consistent with the Global Action Plan endorsed by the World Health Assembly in May 2015. See ID News to learn about an innovative way to develop new antibiotics.

Editorial

The importance of stewardship 3
Taylor G

Overviews

"Do Bugs Need Drugs?" A community education program for the wise use of antibiotics 5
Carson M, Patrick DM

"Choosing Wisely Canada" and antimicrobial stewardship: A shared focus on reducing unnecessary care 9
Born KB, Leis JA, Gold WL, Levinson W

Developing and expanding hospital antimicrobial stewardship: The Ontario experience 14
Nakamachi Y, West S, Dresser L, Morris AM

Summary of the Federal Action Plan on Antimicrobial Resistance and Use in Canada 19
Public Health Agency of Canada in collaboration with the Canadian Food Inspection Agency, Canadian Institutes of Health Research, Health Canada, Agriculture and Agri-Food Canada, Industry Canada, and National Research Council Canada

ID News

Innovation to address antimicrobial resistance 23

Useful links

World Health Organization. Antimicrobial Resistance: Global Report on Surveillance 2014.

World Health Organization. Draft global action plan on antimicrobial resistance 2015.

Upcoming webinar

June 25, 2015: Public Health Agency of Canada. Syphilis among gay, bisexual and other men who have sex with men: A resource for population-specific information.

Public Health Agency of Canada / Agence de la santé publique du Canada

Canada

Canada Communicable Disease Report

The *Canada Communicable Disease Report* (CCDR) is a bilingual, peer-reviewed, open-access online scientific journal published by the Public Health Agency of Canada (PHAC). It provides timely, authorative and practical information on infectious diseases to clinicians, public-health professionals, and policy-makers to inform policy, program development and practice.

Editorial Office

Patricia Huston, MD, MPH
Editor-in-Chief

Mylène Poulin, BSc, BA
A/Managing Editor

Jacqueline Smith
Production Assistant
613-851-5138

Diane Staynor
Editorial Assistant
613-851-5033

Diane Finkle-Perazzo
Cathy Robinson
Copy Editors

CCDR Editorial Board

Michel Deilgat, CD, BA, MD, CCPE
Centre for Foodborne, Environmental and Zoonotic Infectious Diseases, Public Health Agency of Canada

Catherine Dickson, MDCM, MSc
Resident, Public Health and Preventive Medicine, University of Ottawa

Juliana Fracassi, RN, BScN
Infectious Diseases
Ottawa Public Health

Jennifer Geduld, MHSc
Centre for Foodborne, Environmental and Zoonotic Infectious Diseases, Public Health Agency of Canada

Judy Greig, RN, BSc, MSc
Laboratory for Foodborne Zoonoses
Public Health Agency of Canada

Judy Inglis, BSc, MLS
Office of the Chief Science Officer
Public Health Agency of Canada

Mohamed Karmali
Infectious Disease Prevention and Control Branch
Public Health Agency of Canada

Julie McGihon
Public Health Strategic Communications Directorate
Public Health Agency of Canada

Robert Lerch, RN, BScN, MSc
Centre for Immunization and Respiratory Infectious Diseases, Public Health Agency of Canada

Robert Pless, MD, MSc
Centre for Immunization and Respiratory Infectious Diseases, Public Health Agency of Canada

Rob Stirling, MD, MSc, MHSc, FRCPC
Centre for Immunization and Respiratory Infectious Diseases, Public Health Agency of Canada

Jun Wu, PhD
Centre for Communicable Diseases and Infection Control, Public Health Agency of Canada

Canada Communicable Disease Report
Public Health Agency of Canada
130 Colonnade Rd.
Address Locator 6503B
Ottawa, Ontario K1A 0K9
Email: CCDR-RMTC@phac-aspc.gc.ca

To promote and protect the health of Canadians through leadership, partnership, innovation and action in public health.
- Public Health Agency of Canada

Published by authority of the Minister of Health.

© Her Majesty the Queen in Right of Canada, represented by the Minister of Health, 2015

ISSN 1481-8531
Pub.150005

This publication is also available online at http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/15vol41/index-eng.php
Également disponible en français sous le titre: *Relevé des maladies transmissibles au Canada*

The importance of stewardship

Taylor G[1]*

[1]Chief Public Health Officer, Public Health Agency of Canada, Ottawa, ON

*Correspondence: Gregory.Taylor@phac-aspc.gc.ca

Abstract

Antimicrobial resistance is a growing public health threat that at times may appear to be unsolvable. However, in the last few years, great advances have been made to address this issue in Canada and around the world. Our Federal Action Plan on Antimicrobial Resistance and Use in Canada has identified three pillars to address antimicrobial resistance: surveillance, stewardship and innovation. In this supplement are examples of successful stewardship programs for the community, physicians and health care organizations; there are many more. Given that we know successful stewardship programs are possible, it is important to continue this work across the country. Each success helps and multiple successes can create a synergistic effect that can lead to a change in patient expectations and prescribing patterns. Our antimicrobials are a precious resource. It is well worth the effort to contribute to this synergy and build a culture of stewardship so that antimicrobials will continue to be effective for generations to come.

The World Health Organization has identified that antimicrobial resistance is among the top public health threats of the 21st century (1). The causes of resistance are multiple and complex, and at times solutions may seem elusive. The good news is that we are making progress and advances have been made in decreasing antibiotic use in the last few years - in Canada and around the world. In Canada, a lot of work is underway at local, provincial/territorial and federal levels. The recent Federal Action Plan identifies three pillars to address antimicrobial resistance: surveillance, stewardship and innovation (2). A previous issue of the journal addressed surveillance (3). This issue addresses the importance of stewardship - or the responsible planning and management of antibiotic use.

A major focus of stewardship programs is to identify ways, and support the change needed, to decrease antibiotic use. "Do Bugs Need Drugs", for example, is a community-based education program that includes resources with consistent messages for health care professionals, children and their parents or caregivers and teachers, employers and workers, long term care facilities and the general public. Through common messaging, networking, aligning interests, and finding cost-savings through partnerships and economies of scale, this program has started to document consistent reductions in antibiotic prescribing (4).

Choosing Wisely Canada is a physician-led campaign to engage physicians and patients in conversations about unnecessary care, including antibiotic overuse. Physicians have developed recommendations on actions that can be taken to decrease antibiotic prescribing, as well as evidence-based educational materials to facilitate the important discussion between physicians and patients about the benefits of moderating antibiotic use (5).

Antimicrobial stewardship programs in hospitals have been growing since it became a national requirement for hospital accreditation (6). However, there have been challenges in finding the time and resources to develop and maintain these programs. This issue includes a description of a particularly successful program in Ontario that started with a well-resourced program in an academic hospital which was then leveraged and shared with other academic and community-based hospitals, particularly in intensive care units(7). Regional antimicrobial stewardship communities of practice are now becoming established and there are already initial indicators of success.

The good news is that there appears to be a high level of acceptance of these programs. In a recent Canadian study of critical care physicians, for example, 86% of respondents agreed that the patients in their ICU benefited

from an antimicrobial stewardship program and 81% reported that the program increased their knowledge of appropriate antimicrobial use in the ICU setting (8).

This is simply a sampling of some of the innovative work taking place across Canada to promote antibiotic stewardship. There are many other initiatives that have been equally successful or are underway. This is not to underestimate the challenges that remain in finding the time and resources required to develop successful programs. But it is important to note that there is both an additive and synergistic effect of the work that is underway. Each success helps, and multiple successes over time lead to a change in expectations and prescribing patterns. It may be gradual at first, but then a momentum is created, and a "new normal" is established.

Antimicrobial resistance will be with us for some time to come, but we are making strides. Each of us has a role to play in helping to advance stewardship. By combining our efforts we can help to ensure that antimicrobials continue to be effective for many generations to come.

Conflict of interest

None

References

(1) World Health Organization (WHO). Antimicrobial Resistance—Global Report on Surveillance, 2014. Geneva: WHO; 2014. http://apps.who.int/iris/bitstream/10665/112642/1/9789241564748_eng.pdf?ua=1

(2) Public Health Agency of Canada. Summary of the Federal Action Plan on Antimicrobial Resistance and Use in Canada: Building on the Federal Framework for Action. CCDR Suppl. 2015 Jun;41(S-4):18–21. http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/15vol41/dr-rm41s-4/index-eng.php

(3) Can Comm Dis Rep. Antimicrobial resistance Volume 40 S-2, 2014. http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/14vol40/dr-rm40s-2/index-eng.php

(4) Carson M, Patrick DM. "Do Bugs Need Drugs?" A community education program for the wise use of antibiotics. CCDR Suppl. 2015 Jun;41(S-4):4–7. http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/15vol41/dr-rm41s-4/index-eng.php

(5) Born KB, Leis JA, Gold WL, Levinson W. "Choosing Wisely Canada" and antimicrobial stewardship: A shared focus on reducing unnecessary care. CCDR Suppl. 2015 Jun;41(S-4):8–12. http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/15vol41/dr-rm41s-4/index-eng.php

(6) Accreditation Canada. Required Organizational Practices Handbook 2014 Antimicrobial stewardship p.33. https://www.accreditation.ca/sites/default/files/rop-handbook-2014-en.pdf

(7) Nakamachi Y, West S, Dresser L, Morris AM. Developing and expanding hospital antimicrobial stewardship: The Ontario experience. CCDR Suppl. 2015 Jun;41(S-4):13–17. http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/15vol41/dr-rm41s-3/index-eng.php

(8) Steinberg M, Dresser LD, Daneman N, Smith OM, Matte A, Marinoff N, Bell CM, Morris AM. A national survey of critical care physicians' knowledge, attitudes, and perceptions of antimicrobial stewardship programs. J Intensive Care Medicine. 2014 Jul 8. doi:10.1177/0885066614541922

"Do Bugs Need Drugs?" A community education program for the wise use of antibiotics

Carson M[1*], Patrick DM[2, 3]

[1]Alberta Health Services, Edmonton, Alberta
[2]UBC School of Population and Public Health, Vancouver, BC
[3]British Columbia Centre for Disease Control, Vancouver BC

*Correspondence: mary.carson@albertahealthservices.ca

Abstract

"Do Bugs Need Drugs?" is a community and professional education program designed to address antibiotic resistance by decreasing the inappropriate use of antibiotics. Resources have been developed for physicians, pharmacists, nurses and the public, including children, their parents and caregivers, teachers, employers and workers, and long-term care facilities. There are four key strategies: consistent messaging (e.g., handwashing is the best way to stop the spread of infections); networking (through dedicated committee members who have engaged government ministries, professional organizations, health care organizations, academia, industry and businesses, and community groups); aligning interests (e.g., engaging nursing and medical students to deliver a program on antimicrobial resistance (AMR) to Grade 2 students as part of their community health curriculum); and containing costs (e.g., partnering with other organizations for distribution of materials and sharing administrative and printing costs between the Do Bugs Need Drugs programs in Alberta and British Columbia). There is evidence now of an increased willingness in the scientific and medical community to discuss the risks associated with antibiotic use and of growing public awareness that AMR is linked to misuse and overuse of antibiotics.

Introduction

Antibiotic-resistant organisms are responsible for an increasing proportion of community-acquired infections across Canada. All physicians are familiar with the present day reality of community-associated methicillin-resistant *Staphylococcus aureus* (MRSA) in skin and soft tissue infections as well as the precipitous rise of resistance to fluoroquinolones and co-trimoxazole in community uropathogens such as *E. coli*.

"Do Bugs Need Drugs?" is a community education program designed to address antibiotic resistance by decreasing the inappropriate use of antibiotics. Beginning as a small six-month pilot in 1997 in Grande Prairie, Alberta, the program expanded to Edmonton in 2000 and to all of Alberta and to British Columbia in 2005. Resources have been developed for physicians, pharmacists, nurses and the public, including children, their parents and caregivers, teachers, employers and workers, and long-term care facilities. Programs are supported by print materials, a website, television and transit advertising, and a twitter account. The Do Bugs Need Drugs website is bilingual and some print materials are available in multiple languages (1).

British Columbia has seen reductions in the rate of community prescribing at the population level, especially for respiratory tract infection in children, the major early target of the program (2). In Alberta, consistent reductions in antibiotic prescribing in long-term care centres have been achieved with implementation of an antimicrobial stewardship strategy that includes education for staff and feedback on antibiotic prescribing rates (unpublished data; Mary Carson). The objective of this article is to summarize the key strategies of this community-based antimicrobial stewardship program.

Four key strategies

The success of Do Bugs Need Drugs can be attributed in part to four strategies: consistent messaging, networking, aligning interests, and containing costs.

Consistent messaging

Three key messages were established when the program was created and continue to be the focus of educational efforts today. These have been incorporated into program materials at all levels from health care professionals to preschoolers.

- Handwashing is the best way to stop the spread of infections.
- Bacteria and viruses are different and antibiotics do not work against viruses.
- Use antibiotics wisely to limit development of antibiotic resistance.

While it is relatively easy, for example, to instruct young children how to properly wash their hands, teaching antibiotic resistance is considerably more challenging. However, even young children can learn about the different kinds of germs and that antibiotics will "go into" bacteria but not viruses. We feel that consistency and repetition of these key messages has been central to successfully mounting a public education campaign.

Networking

Networking in an essential activity of Do Bugs Need Drugs as it is through community partners that the program was initiated and continues to be delivered. Much of this has been achieved through the Do Bugs Need Drugs committee structures in Alberta and British Columbia. Initially these committees included a medical microbiologist and infectious disease specialist, an antimicrobial utilization and infectious diseases pharmacist, a pharmacist from the pharmaceutical industry, a nurse associated with the clinical practice guideline program, a clinical professor from a faculty of pharmacy, and a representative from a health NGO. Subsequently, epidemiologists, members of professional colleges, and health practitioners involved with public health, long-term care and occupational health have become part of the team.

Committee members have been exceptionally dedicated to developing the Do Bugs Need Drugs program and have given their time without expectation of remuneration or personal recognition. They have also engaged a wide network of community partners, including government ministries, health care professional organizations, academic institutions, industry and businesses, long-term care facilities, schools, teachers, child care groups, church groups, youth organizations and individual citizens, all of which have assisted with program dissemination.

Aligning interests

Because Do Bugs Need Drugs relies to a large extent on partnerships with external organizations/groups for program delivery, it is important to identify partners with aligned interests and then to develop or tailor programs to meet their needs.

One example is the Grade 2 Program, which is designed to be used by guest presenters in the classroom. Training for the presenters, a teaching kit and resources for the Grade 2 students and school are provided by Do Bugs Need Drugs, while the program is delivered primarily by nursing and medical students as part of their community health requirement. This model has the advantage of educating both young children and future health care workers and has been a core activity of Do Bugs Need Drugs since 1997.

The Grade 2 Program depends on maintaining collaborative relationships with nursing and medical faculties and ensuring that Do Bugs Need Drugs materials are aligned with the academic expectations of the college or

university. This approach has been used with the majority of our programs as it facilitates dissemination of key messages while providing a service that addresses the needs of partner organizations.

Containing costs

The cost of delivering Do Bugs Need Drugs provincially in Alberta is about five cents per Albertan per year. Several factors contribute to cost containment, including reliance on partner organizations for program delivery and economies of scale associated with implementation of Do Bugs Need Drugs programs in both Alberta and British Columbia. An example of reliance on partner organizations is—instead of direct mailing to businesses in Alberta about the availability of materials for the workplace, we have partnered with the Alberta Health Services Workplace Immunization Program and Victorian Order of Nurses to distribute packages of employer/worker materials to businesses in conjunction with workplace influenza clinics. With respect to economies of scale, Do Bugs Need Drugs programs in Alberta and British Columbia enjoy reduced printing and administrative costs as a result of combined print orders and use of the same teaching kits and web resources in both provinces.

Discussion

Program development and delivery is not easy. Antibiotic resistance is a challenging concept not only for public education but for health care professionals as well. Overcoming the view that antibiotic resistance is not an urgent issue can be daunting and requires perseverance and endurance. We have found, however, that over time the public has become more aware of what antibiotic resistance is and how it is caused. In 1998, 27% of respondents to a public survey were able to correctly define antibiotic resistance. In a 2014 public survey in BC, 77% of those surveyed were able to attribute antibiotic resistance to misuse or overuse. The growing body of evidence about the global and personal risks associated with antibiotic use and the increased willingness of the scientific and medical community to discuss these risks in the media are important factors in heightening public awareness.

Following excellent international work in the area of antimicrobial resistance (3, 4), the Public Health Agency of Canada has led the development of a Federal Action Plan on Antimicrobial Resistance and Use (5). Importantly, the Canadian strategy addresses antibiotic use in agriculture and the need to develop an agri-food, antimicrobial usage tracking system (5). We are encouraged by this recent activity and are hopeful that the momentum behind antimicrobial stewardship campaigns in Canada continues to grow.

Conclusion

Antimicrobial stewardship can be supported at the local level through public education campaigns such as Do Bugs Need Drugs. The opportunities for initiating antimicrobial stewardship campaigns within a community are innumerable and there is no absolute right or wrong approach. What is most important is to get started.

Acknowledgements

The authors wish to acknowledge Edith Blondel-Hill and Susan Fryters for their seminal work in establishing the "Do Bugs Need Drugs?" program.

Conflict of interest

None

Funding

Alberta Health Services for funding in Alberta; BC Ministry of Health, Pharmaceutical Services Branch, for funding in British Columbia.

References

(1) Do Bugs Need Drugs? A Community Program for Wise Use of Antibiotics. http://www.dobugsneeddrugs.org/about/

(2) BC Centre for Disease Control. Antibiotic Utilization in the Province of British Columbia, 2013. Vancouver, BC: BC Centre for Disease Control; 2014 Nov. http://www.bccdc.ca/NR/rdonlyres/C3BFA092-7C55-46ED-BFC9-3CD91E593A5A/0/Reportonantibioticutilization2013_Nov12_FINAL.pdf

(3) World Health Organization (WHO). The evolving threat of antimicrobial resistance: Options for Action, 2012. Geneva: WHO; 2012. http://whqlibdoc.who.int/publications/2012/9789241503181_eng.pdf?ua=1

(4) Government of the United States. National Action Plan for Combating Antibiotic-resistant Bacteria. Washington: Government of the United States; 2015 Mar. https://www.whitehouse.gov/sites/default/files/docs/national_action_plan_for_combating_antibotic-resistant_bacteria.pdf

(5) Government of Canada. Federal Action Plan on Antimicrobial Resistance and Use in Canada: Building on the Federal Framework for Action. 2015 Mar 31. http://healthycanadians.gc.ca/publications/drugs-products-medicaments-produits/antibiotic-resistance-antibiotique/action-plan-daction-eng.php.

"Choosing Wisely Canada" and antimicrobial stewardship: A shared focus on reducing unnecessary care

Born KB[1*], Leis JA[2], Gold WL[3], Levinson W[1]

[1] Choosing Wisely Canada, University of Toronto, Toronto, ON
[2] Division of Infectious Diseases and Centre for Quality Improvement and Patient Safety, University of Toronto, Toronto, ON
[3] Division of Infectious Diseases, University of Toronto, Toronto, ON

*Correspondence: karen.born@mail.utoronto.ca

Abstract

There is a growing movement in medicine which recognizes that some tests, treatments or procedures do not add value for patients, and may even cause harm. The "Choosing Wisely Canada" campaign is a grassroots, physician-led campaign to engage physicians and patients in conversations about overuse of unnecessary tests, treatments and procedures to improve the quality of health care. This article reviews the underlying principles of this campaign and its spread across Canada. It also highlights the alignment between the principles of Choosing Wisely Canada with those of antimicrobial stewardship, which share similar motivations, challenges and opportunities.

Introduction

Improving quality, safety and patient centeredness are common objectives of health care providers, organizations and systems across Canada. Canadian and international studies have demonstrated the ubiquity of adverse events and harm associated with medical care (1, 2). The patient safety movement has highlighted that some of this harm is preventable and has implemented a variety of strategies such as checklists, bundles, improved measurement and continuing professional development programs. An important target in the patient safety movement is preventing unnecessary care, defined as medical care being delivered to patients that provides no benefit, or lacks a clinical indication. When care provides no benefit or is not clinically indicated, the quality improvement target becomes unnecessary care itself. Unnecessary care is driven by a number of complex forces such as established practice habits, time pressures, discomfort with diagnostic uncertainty and perceived patient expectations.

Although it may be well-intentioned, unnecessary care can trigger a "cascade effect" of further tests, procedures and treatments that can cause physical and psychological harms (3). Further investigation can lead to adverse events, complications, as well as heightened patient stress and anxiety. Unnecessary care also strains already stretched health care budgets. Data from the United States reports that 30% of health care spending is wasteful (4). While there is no similar global figure in Canada, there is rapidly expanding literature demonstrating the pervasiveness of unnecessary tests, treatments and procedures (5).

While physicians and patients agree that improving quality of care and curbing overuse of unnecessary tests, treatments and procedures is an important goal, changing physician behaviours and patient expectations is challenging and complex. The "Choosing Wisely Canada" campaign is aimed at addressing these complex causes by providing evidence-based educational materials to both physicians and patients, by encouraging a conversation about making informed choices, and by facilitating a broader public dialogue around unnecessary care. The goal of this article is to review the underlying principles of this campaign and to highlight the alignment between the principles of Choosing Wisely Canada with those of antimicrobial stewardship.

Choosing Wisely Canada: A physician-led campaign

Choosing Wisely Canada was launched in April 2014. It was modelled upon the American Board of Internal Medicine Foundation Choosing Wisely campaign launched in April 2012 that encourages physicians and patients to talk about unnecessary tests, treatments and procedures to improve the value of care, and reduce harm.

To date, 45 Canadian specialty societies have joined the campaign. Participating societies commit to developing a "Top 5 list of tests and treatments physicians and patients should question." These recommendations state what physicians should stop doing; there are over 100 recommendations at present and more are about to be released.

"More medicine is not always better medicine"

Choosing Wisely Canada recommendations and lists are meant to spur conversations between patients and physicians to determine the appropriate course of care and treatment plan together. Each list contains tests, treatments and procedures within a specialty's scope of practice for which there is excellent evidence of overuse, waste or harm to patients. These lists are publicly available on the Choosing Wisely Canada website.

Specialty societies have used various processes for determining lists, but all have done so in accordance with the following principles:

1. The development process is thoroughly documented and publicly available.
2. Each recommendation is within the specialty's scope of practice.
3. Tests, treatments and procedures included are those that: (a) are frequently used, and (b) may expose patients to harm or stress.
4. Each recommendation is supported by evidence.

There is a growing international movement around this approach with Choosing Wisely programs being launched in 15 countries. An international working group, led by Choosing Wisely Canada, has articulated a set of five principles that should be incorporated into a Choosing Wisely campaign, which are to be physician-led, patient-focused, evidence-based, multi-professional and transparent (6).

Antimicrobial stewardship and Choosing Wisely

The management of infectious disease syndromes is often empiric, where treatment is initiated in the absence of full evidence, and on an educated clinical decision. In some circumstances, results may be pending at the time of initiation of antimicrobial therapy and in other cases; results may be negative when infection is in fact present. The wise choice of diagnostic testing—including when not to perform testing—is an important principle common to both Choosing Wisely Canada and the management of infectious diseases, to ensure rational and safe prescription of antimicrobial therapy (7).

Beyond judicious decisions around testing, there are additional principles of resource stewardship that have been a long-standing focus for infectious disease specialists (8). In an era of increasing antimicrobial resistance with limited availability of new and effective antibiotic agents, antimicrobial stewardship programs have emerged as a fundamental component of health care systems in Canada. Antimicrobial stewardship programs are one way that organizations and physicians are implementing the motivations behind Choosing Wisely into practice.

Antimicrobial stewardship programs have recently become a required organizational practice from Accreditation Canada. Evidence suggests that for Antimicrobial stewardship programs to be effective, local strategies need to be in place to ensure that this now mandated program has grassroots buy-in from frontline physicians (9). In contrast, Choosing Wisely Canada is fundamentally a grassroots campaign; nevertheless there is close alignment

with the principles and goals of antimicrobial stewardship programs. Both programs aim to optimize patient outcomes while minimizing unintended harms associated with antimicrobial use, with the secondary goal of reducing health care costs without impacting quality.

Antimicrobial stewardship programs face similar challenges around changing medical practice as well as patient expectations. There is extensive literature regarding antimicrobial stewardship interventions and their impact on improving antimicrobial use, curbing antimicrobial resistance, and improving clinical outcomes (10, 11). Despite this, overuse of antimicrobials and their associated adverse effects remains a major day-to-day challenge. Antimicrobial prescribing is a behaviour that is influenced by many complex social and cultural determinants, as well as ingrained individual behaviours that have typically been influenced by perceived patient expectations and other factors (12).

Choosing Wisely Canada offers an additional forum to facilitate conversations between physicians and patients around antimicrobial prescribing practices. **Table 1** below demonstrates a selection of recommendations from Canadian and American specialty society Choosing Wisely lists around unnecessary or inappropriate antimicrobial use within the purview of their clinical practice. Many of these examples of antimicrobial overuse relate to outpatient practice, where antimicrobial stewardship has historically been more challenging to implement (13). Choosing Wisely recommendations focused on antibiotic use provide an opportunity to foster broader discussions around appropriate antimicrobial use, beyond what can be addressed by hospital antimicrobial stewardship programs.

Table 1: Examples of Canadian and American specialty society Choosing Wisely recommendations on antimicrobials

Groups	Recommendations
Canadian Specialty Society	
Canadian Geriatrics Society	Don't use antimicrobials to treat bacteriuria in older adults unless specific urinary tract symptoms are present.
The College of Family Physicians of Canada	Don't use antibiotics for upper respiratory infections that are likely viral in origin, such as influenza-like illness, or self-limiting, such as sinus infections of less than seven days of duration.
Canadian Urological Society	Don't use antimicrobials to treat asymptomatic bacteriuria in the elderly.
Groups	**Recommendations**
American Specialty Society	
American Academy of Dermatology	Don't prescribe oral antifungal therapy for suspected nail fungus without confirmation of fungal infection.
American Academy of Dermatology	Don't use oral antibiotics for treatment of atopic dermatitis unless there is clinical evidence of infection.
American Academy of Family Physicians	Don't routinely prescribe antibiotics for acute mild-to-moderate sinusitis unless symptoms last for seven or more days, or symptoms worsen after initial clinical improvement.
American Academy of Ophthalmology	Don't order antibiotics for adenoviral conjunctivitis (pink eye).

Shared challenges and opportunities

Choosing Wisely Canada and antimicrobial stewardship programs share many of the same motivations and challenges. In the context of scarce health care resources, both initiatives can be framed by critics as cost-cutting or rationing exercises, rather than efforts to improve quality of care (3). Choosing Wisely Canada and international campaigns have remained independent from government, and it's clear to all stakeholders that recommendations should not be used by decision makers to delist services or determine payment. In fact, such delisting would be difficult to implement given that recommendations are not "never" events and rely on clinician decision making. Additionally, there are measurement challenges associated with both efforts as it can be difficult to quantify harm that has been avoided, or "appropriate" care given. Data are vital to garnering support from physicians, funders and stakeholders for these initiatives and there are efforts underway to better measure and demonstrate the impact of restraint on patient outcomes.

In terms of opportunities, there is a great deal of alignment between the principles of Choosing Wisely Canada and antimicrobial stewardship programs. Similarly, there are many shared levers of change for these efforts, which are physician-led initiatives to change practice, avoid harm and improve stewardship of valuable health care resources. These efforts can in turn influence public and patient expectations, and help to foster a conversation to make smart and effective choices to ensure high quality care.

Conflict of interest

None

Funding

None

References

(1) Brennan TA, Leape LL, Laird NM, Hebert L, et al. Incidence of adverse events and negligence in hospitalized patients—Results of the Harvard Medical Practice Study. N Engl J Med. 1991;324:370–6.

(2) Baker GR, Norton PG, Flintoft V, et al. The Canadian Adverse Events Study: The incidence of adverse events among hospital patients in Canada. CMAJ. 2004;170(11):1678–86.

(3) Deyo R. Cascade effects of medical technology. Ann Rev Pub Health. 2002;23:22–44.

(4) Institute of Medicine (US) Roundtable on Evidence-Based Medicine. Yong PL, Saunders RS, Olsen LA, editors. The Healthcare Imperative: Lowering Costs and Improving Outcomes—Workshop Series Summary. Washington: National Academies Press (US); 2010. p. 1–9.

(5) Emery DJ, et al. Overuse of magnetic resonance imaging. JAMA Intern Med. 2013;173(9):823–5.

(6) Levinson W, Kallewaard M, Bhatia RS, et al. 'Choosing Wisely': A growing international campaign. BMJ Qual Saf. 2014 Dec 31. doi:10.1136/bmjqs-2014-003821

(7) Mandell, LA, Wunderink RG, Anzueto A, et al. Infectious Diseases Society of America/American Thoracic Society Consensus Guidelines on the Management of Community-Acquired Pneumonia in Adults. Clin Infect Dis. 2007;44:S27–71.

(8) Dellit T, Owens R, McGowan J, et al. Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship. Clin Infect Dis. 2006;44:159–77

(9) Bal AM, Gould IM. Antibiotic stewardship: Overcoming implementation barriers. Curr Opin Infect Dis. 2011;24(4):357–62.

(10) Cosgrove SE, Seo SK, Bolon MK, et al. Evaluation of postprescription review and feedback as a method of promoting rational antimicrobial use: A multicenter intervention. Infect Control Hosp Epidemiol. 2012;33(4):374–80.

(11) Elligsen M, Walker SA, Pinto R, Simor A, et al. Audit and feedback to reduce broad-spectrum antibiotic use among intensive care unit patients: A controlled interrupted time series analysis. Infect Control Hosp Epidemiol. 2012;33(4):354–61.

(12) Charani E, Castro-Sanchez E, Sevdalis N, Kyratsis Y, et al. Understanding the determinants of antimicrobial prescribing within hospitals: The role of "prescribing etiquette." Clin Infect Dis. 2013;57(2):188–96.

(13) Drekonia DM, Filice GA, Greer N, et al. Antimicrobial stewardship in outpatient settings: A systematic review. Infect Control Hosp Epidemiol. 2015;36(2):142–52.

Developing and expanding hospital antimicrobial stewardship: The Ontario experience

Nakamachi Y[1,2], West S[1], Dresser L[1,3], Morris AM[1,4*]

[1]Mount Sinai Hospital, University Health Network, Toronto, ON

[2]Department of Pharmacy, University Health Network, Toronto, ON

[3]Leslie Dan Faculty of Pharmacy, University of Toronto, Toronto, ON

[4]Mount Sinai Hospital, University Health Network, and University of Toronto, Toronto, ON

***Correspondence**: amorris@mtsinai.on.ca

Abstract

Mount Sinai Hospital and University Health Network, two academic health science centres in Toronto, Ontario, jointly established a robust, well-resourced antimicrobial stewardship program (ASP). Over the course of four years, we spread our program to five intensive care units (ICUs), learned which change management practices worked and which did not, and leveraged our ICU successes to other areas of our hospitals. We identified the following two factors as critical to establishing ASPs in hospitals: strong leadership with clear accountability; and valid, reliable data to monitor progress. Subsequently we have led the spread of our program to 14 academic hospital ICUs, and more recently we leveraged to help community hospitals implement ASPs without in-house infectious diseases specialists. We introduced three new data fields into the provincial critical care information system: days of antibacterial therapy, days of antifungal therapy, and ICU-onset *C. difficile*, which will help standardize data collection moving forward. This model—starting with academic health sciences centres, and antimicrobial stewardship experts and leaders who are then supported to mentor and develop new experts and leaders—could be copied in other jurisdictions both within and outside of Canada.

Introduction

Antimicrobial stewardship is a programmatic effort aimed at optimizing the appropriate use of antimicrobials (1). In this article, we will describe the Mount Sinai Hospital–University Health Network Antimicrobial Stewardship Program involvement in the spread of hospital-based antimicrobial stewardship in three phases: 1) Academic Hospital Foundation; 2) Academic Hospital Spread; 3) Community Hospital Scale. Our experience and lessons learned developing system-wide improvement and change in antimicrobial use might be useful to inform stewardship planning in Canada and other jurisdictions.

Academic Hospital Foundation

In 2009, Mount Sinai Hospital and University Health Network, two academic health science centres in Toronto, Ontario, jointly established a robust, well-resourced antimicrobial stewardship program (ASP). From the start, the hospital leadership at both institutions recognized the importance of antimicrobial stewardship as a patient safety imperative.

Our first foray into change management was prospective audit-and-feedback in intensive care units (ICUs): an infectious diseases physician and/or pharmacist would meet with the ICU teams on a daily basis, review antimicrobial practices on each patient, and provide coaching on best practices. Advice offered would include reducing use of unnecessarily broad-spectrum antimicrobials, limiting duration of therapy to those best supported by evidence, and emphasizing the need for source control where appropriate. The focus for the ASP was

common infections managed by all physicians and not those that require consultation with an infectious diseases expert. Over the course of four years, we spread our program to five intensive care units, learned which change management practices worked and which did not, and leveraged our ICU successes to other areas of our hospitals. We identified the following two factors as critical to establishing ASPs in hospitals: strong leadership with clear accountability; and valid, reliable data to monitor progress.

Strong leadership and clear accountability

Dedicated individuals who led the program throughout the hospitals were key ingredients to the success of our ASP program. Although the most common model is an infectious diseases physician as leader, the physician does not need to be an expert in infectious diseases, and having a pharmacist as co-leader is often beneficial. In our experience, a pharmacist leading without a physician leader posed significant challenges. Our ASP leaders were respected clinicians, and they needed to have protected time with adequate salary support in order to carry out their ASP roles. We believe this initial investment was critical to our success.

For our ASP to be established effectively, it also required a champion from senior hospital leadership with credibility, authority, and a discretionary budget (2). For us, this leader was the Vice-President, to whom the ASP team was accountable. Traditionally, ASPs report to medical advisory committees (directly, or via pharmacy and therapeutics committees) or may be part of quality or infection control committees. Although these committees are important advocates for the work of ASPs, they may lack the authority and access to resources that ASPs require.

Valid and reliable data

Antimicrobial stewardship is a health care improvement initiative that often meets the "triple aims" of health care: it improves the quality of care, saves money, and improves the patient experience (3). Therefore, it must be laid upon a foundation of good data. In Canada, most hospital systems are designed to meet functional needs and do not lend themselves easily to the capture and retrieval of accurate and reliable data. Retrieving useable and meaningful data in a timely manner requires institutional investment. What we found initially was that the data were available, but the task of obtaining the data was left to individuals who neither had the expertise in these data systems nor the relationships with individuals who had such expertise. As a result, we needed to invest in getting the right person in place. Good data is necessary to assess progress. Although data problems can be complex, when appropriate resources were applied, solutions were achieved more easily than originally anticipated.

Academic Hospital Spread

In 2011, the Council of Academic Hospitals of Ontario awarded our ASP with a grant to implement antimicrobial stewardship programs in teaching hospitals with intensive care units. This was part of the Council's funding program Adopting Research to Improve Care (ARTIC), sponsored by the Ontario Ministry of Health and Long-Term Care. We worked with academic hospitals across the province to implement ASPs involving14 ICUs (including three pediatric ICUs). This "Antimicrobial Stewardship Programs in ICUs" project was based on what we learned from the successes and challenges we faced with our own program: the importance of strong leadership; clear accountability; clinical credibility; and a focus on obtaining timely, reliable and valid data.

The ARTIC ASP in ICUs project included coaching each hospital through the various stages of planning, implementing, evaluating and sustaining the establishment of an ASP. Each hospital identified an infectious diseases physician and a pharmacist who would serve as the subject matter experts and the ASP leads in their hospital. We found that antimicrobial stewardship expertise was not abundant in Ontario, which created a barrier for implementation. Many of the hospitals had to delay implementation to recruit or train subject matter experts. We recognized early on that there were knowledge gaps that needed to be addressed, even amongst experts in infectious diseases. Although all infectious diseases experts should be antimicrobial stewards, in fact, much of their practice is devoted to complex and rare infections. As a result they often do not have the opportunity to hone their expertise on the common infection syndromes that are at the heart of antimicrobial stewardship. We developed learning modules to address this knowledge gap and used whiteboard animation (short, scripted videos) to assist in the knowledge translation (4). We set clear reporting standards for the type of data we

required (which included detailed antimicrobial usage and resistance data), and when it needed to be reported. It was important to ensure that each program was able to produce reliable and validated data in a timely manner.

We conducted on-site visits to each of the hospitals for a "project launch," and also carried out interviews with key stakeholders prior to each site implementing their ASP initiative. This was necessary to help understand the logistical, interpersonal and institutional challenges that each of the hospitals faced. We visited once more, approximately three months after ASP implementation, interviewed the stakeholders again, and provided the executive sponsor of the program and the ASP leaders with a report of our findings. These post-implementation visits not only assured us that milestones had been met but, more importantly, they allowed us to provide feedback to the executive sponsors. Several themes emerged from our visits, but invariably the advice we provided emphasized either: a) the need to improve the organizational structure to outline clear accountability; or b) the need for information technology support to improve timely and reliable data retrieval.

An important element to the ARTIC ASP in ICUs project was the development of antimicrobial measures for all high acuity ICUs in Ontario. Since 2008, Ontario's Critical Care Information System has been collecting real-time information on patients in Ontario's ICUs (5). Initially established to help identify ICU beds for critically ill patients, the amount and type of information contained in this information system has grown steadily. The ARTIC ASP in ICUs project team identified the opportunity to synergize with this information system early on. Working closely with Critical Care Services Ontario and CritiCall (the organization maintaining this information system), our project team helped introduce three new data fields: days of antibacterial therapy; days of antifungal therapy; and ICU-onset *C. difficile*. Although we required the hospitals engaged in our project to report data above and beyond these newly created data fields, the new fields helped set a framework for antimicrobial stewardship data throughout hospitals in the province.

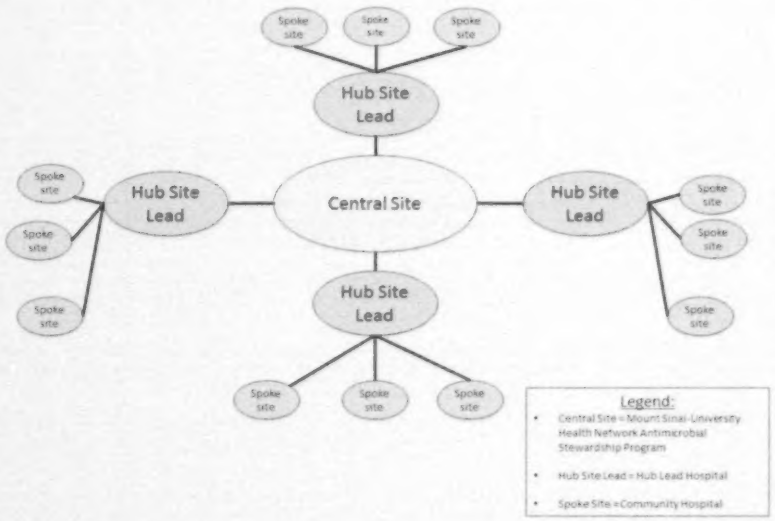
Upon the completion of the ARTIC ASP in ICUs project, all but one academic hospital in Ontario with an ICU had an established antimicrobial stewardship program, and each of these programs was able to report ICU-specific antimicrobial resistance and usage. Furthermore, all Level 2 and Level 3 ICUs in the province—regardless of their affiliation with academic health sciences centres—were able to readily access their ICU's days of antibacterial therapy, days of antifungal therapy, ICU-onset *C. difficile* infection, and even antimicrobial-free days. This makes Ontario the largest jurisdiction in the world (with over 200 ICUs, housing approximately 2,000 critical care beds) to be able to have real-time access to antimicrobial stewardship metrics for such a large number of patients. This set the stage for scaling antimicrobial stewardship to community hospitals.

Community Hospital Scale

In 2014, the Council of Academic Hospitals of Ontario partnered with Health Quality Ontario to fund a pilot program that would test the ability to "spread and scale" an ARTIC program. We were awarded this first-time grant for ASP development spread and scale.

Our community-based project used a "hub and spoke" model to demonstrate that the tools developed and the knowledge and expertise gained during the original project could be leveraged to help community hospitals implement ASPs without in-house infectious diseases specialists (**Figure 1**). We chose pharmacist and physician leaders from four established ASP "hub" sites (including one non-academic site) to each mentor approximately three community hospital "spoke" sites. Our ASP leaders offered guidance, but fundamentally the community program relied on the expertise of the hubs and the resourcefulness and dedication of the spokes.

Figure 1: Hub and spoke model



We are now four months into this community hospital project. Regional antimicrobial stewardship communities of practice are now becoming established. Informal observations and feedback have already been positive, instilling a high degree of confidence that the program will be successful.

Conclusion

In summary, we found that the support our team received at our two academic institutions, Mount Sinai Hospital and University Health Network, fostered the success of our ASP. Subsequently, a larger group of Ontario health care leaders have allowed antimicrobial stewardship to grow organically throughout a large Canadian province in only four short years. Ontario has now set a bar for antimicrobial stewardship implementation. This model—starting with academic health sciences centres, and antimicrobial stewardship experts and leaders who are then supported to mentor and develop new experts and leaders—could be copied in other jurisdictions both within and outside of Canada.

Acknowledgements

We would like to acknowledge the various individuals who have demonstrated strong leadership and have supported the Mount Sinai Hospital–University Health Network Antimicrobial Stewardship Program over the years: Dr. Charlie Chan, Dr. Rupert Kaul, Dr. Conrad Liles, Scott McIntaggart, Emily Musing, Dr. Gary Newton, Dr. Maureen Shandling, Dr. Tom E. Stewart, and Bill Wilson. Additionally, we are grateful for the continued support of Karen Michell and Michelle Grouchy (Council of Academic Hospitals of Ontario), and Lee Fairclough and Mark Robson (Health Quality Ontario). Finally, special thanks to all of our colleagues and collaborators who have helped bring antimicrobial stewardship to Ontario.

Funding

The Council of Academic Hospitals in Ontario ARTIC ICU in ASP project was supported by a grant from the Council of Academic Hospitals of Ontario and the Ontario Ministry of Health and Long-Term Care, which provided salary support to Dr. Yoshiko Nakamachi and Dr. Andrew Morris. The Council of Academic Hospitals of

Ontario–Health Quality Ontario ARTIC CHILL project was supported by a grant from the Council of Academic Hospitals of Ontario and Health Quality Ontario, which provided salary support to Sarah West.

Conflict of interest

None

References

(1) Dellit TH, Owens RC, McGowan JE Jr., Gerding DN, Weinstein RA, Burke JP, et al. Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship. Clin Infect Dis. 2007;44(2):159–77.

(2) Morris AM, Stewart TE, Shandling M, McIntaggart S, Liles WC. Establishing an antimicrobial stewardship program. Healthc Q. 2010;13(2):64–70.

(3) Berwick DM, Nolan TW, Whittington J. The triple aim: Care, health, and cost. Health Aff (Millwood). 2008;27(3):759–69.

(4) Dresser L, Biomedia K. Antimicrobial stewardship in critical care [whiteboard animation]. 2013. https://www.youtube.com/watch?v=-G4cEYQBVu4

(5) Ontario Ministry of Health and Long-Term Care—Critical Care Strategy. Critical Care Information System. 2012 Jun 25. http://www.health.gov.on.ca/en/pro/programs/criticalcare/ccis.aspx.

Summary of the Federal Action Plan on Antimicrobial Resistance and Use in Canada

Public Health Agency of Canada* in collaboration with the Canadian Food Inspection Agency, Canadian Institutes of Health Research, Health Canada, Agriculture and Agri-Food Canada, Industry Canada, and National Research Council Canada

*Correspondence: Lindsay.noad@phac-aspc.gc.ca

Abstract

In October 2014, the Government of Canada released *Antimicrobial Resistance and Use in Canada: A Federal Framework for Action* and has recently followed up with its *Federal Action Plan on Antimicrobial Resistance and Use in Canada*. The Federal Action Plan outlines concrete deliverables in support of the three areas of focus identified in the Federal Framework. Highlights of the work that will be undertaken by the Public Health Agency of Canada include: establishing the Canadian Antimicrobial Resistance Surveillance System to strengthen coordination and integration of antimicrobial resistance (AMR) and antimicrobial use (AMU) activities and information; undertaking a scan to identify potential gaps in infection prevention and control practices; and building on lessons learned from the November 2014 AMR awareness campaign to inform future public awareness and education activities. The Government of Canada remains committed to taking action on AMR and AMU and will continue to identify new activities to help combat the spread of AMR. The Federal Action Plan is an evergreen document that will be updated regularly to keep Canadians informed of activities and ongoing progress in implementing the Federal Framework.

Introduction

Antimicrobial resistance (AMR) is a serious and growing global public health threat. In response to this threat, in October 2014 the Government of Canada released *Antimicrobial Resistance and Use in Canada: A Federal Framework for Action* (1). The Framework outlines a coordinated, collaborative federal approach to responding to the threat of AMR through action in three areas: surveillance, stewardship, and innovation. Furthermore, the Framework serves as a vehicle to engage partners and stakeholders in discussions on collective actions that can be taken to enhance the effectiveness of individual actions within sectors implicated in AMR.

The Action Plan

As a follow-up to the Framework, the *Federal Action Plan on Antimicrobial Resistance and Use in Canada: Building on the Federal Framework for Action* (2) was released in March 2015. While the Framework identifies concrete actions by the Government of Canada to reduce the threat and impact of AMR, the purpose of the Action Plan is to outline the specific deliverables being undertaken by federal departments and agencies under each action item, and the targeted completion date for each deliverable. The Action Plan is an evergreen document that will be updated regularly so that it remains reflective of the work that is underway and our plans for the future.

A shared responsibility

As noted in the Framework, addressing the growing threat of AMR in Canada is a shared responsibility that crosses all levels of government (federal, provincial and territorial) and multiple sectors (e.g., public health, health care, animal health, agriculture). When the Framework was released, it outlined the federal role for AMR of several departments: Public Health Agency of Canada Health Canada Canadian Food Inspection Agency Canadian Institutes of Health Research and Agriculture and Agri-food Canada). The scope of work included in the Action Plan has been expanded to include two additional federal departments: Industry Canada and National Research Council Canada.

As indicated in the Framework, provinces, territories, and other stakeholders also play a key role by virtue of their responsibility for the delivery of health care, approval of antimicrobials for medical coverage, and the regulation of antimicrobial use (AMU) in veterinary medicine and agriculture. The Action Plan reaffirms that the Government of Canada is committed to working with all jurisdictions and stakeholders to deliver on the Action Plan.

Leadership

In addition to its work in the areas of surveillance, stewardship and innovation, the Government of Canada is committed to taking a leadership role both nationally and internationally. In support of this commitment, the Action Plan highlights key leadership activities being undertaken. These include: Canada's engagement with international partners on the development and implementation of the World Health Organization's Global Action Plan on AMR; efforts to develop a pan-Canadian approach to address AMR with federal, provincial and territorial (F/P/T) partners, and human health, animal health, agri-food and industry stakeholders; international coordination of research efforts; and, as part of the work under the Global Health Security Agenda, supporting the development of an integrated and global package of activities to combat AMR that spans human, animal, agricultural, food, and environmental sectors.

Surveillance

Action 1: Establish and strengthen surveillance systems to identify new threats or changing patterns in antimicrobial resistance and use, in human and animal settings.

Comprehensive information is needed on the scope of the problem of AMR, particularly outside of hospital settings (e.g., how are antimicrobials being used; how many bacteria are resistant; to which drugs; how are they being spread). This information is necessary to determine the full magnitude of the problem and is essential to monitor the effectiveness of stewardship interventions—this information can only be gathered from effective surveillance.

In Canada, there are already robust surveillance systems in place, and we will continue these existing surveillance activities, as well as the supporting laboratory services, in support of efforts to combat AMR. These systems will also be built upon to enhance our surveillance of AMR. Examples of some of the deliverables under this action area include:

- The Public Health Agency of Canada will work to establish the Canadian Antimicrobial Resistance Surveillance System to strengthen coordination and integration of AMR/AMU activities and information. (Target completion date: Fall 2016)
- The Canadian Food Inspection Agency and Agriculture and Agri-food Canada will work on the development of key components of an agri-food AMU monitoring, tracking, and reporting system. This will include identifying data collection and reporting needs across stakeholders and decision makers, including needs for international, national and P/T reporting. (Target completion date: Spring 2016)
- The Canadian Institutes of Health Research, along with the Public Health Agency of Canada, will support research and dissemination of results regarding studies on interventions and surveillance of AMR. (Target completion date: December 2019)

Stewardship

AMR occurs whenever antimicrobials are used and will therefore be a constant factor in both human and veterinary medicine. Strong stewardship practices by everyone are therefore essential to continue to combat AMR. Given the importance of stewardship, a number of activities are outlined under the two actions in this area.

Action 2: Strengthen the promotion of the appropriate use of antimicrobials in human and veterinary medicine.

An important consideration in preserving the effectiveness of existing antimicrobial drugs is promoting disease prevention efforts with the aim of minimizing or eliminating the need for antimicrobials. In addition to infection prevention and control, the Government of Canada will continue efforts to facilitate and enhance education and awareness on when and how to use antimicrobials, as well as the choice of the correct antimicrobials to use for treatment of certain conditions. In addition, significant progress in the agri-food sector has been made to promote the prudent use of antimicrobials in food animal production. Key activities moving forward involving both sectors include:

- The Public Health Agency of Canada will build on lessons learned from the November 2014 AMR awareness campaign to inform future public awareness and education activities for the general public, and for health professionals working in community, hospital and long-term care settings. (Target completion date: Spring 2015)
- The Public Health Agency of Canada will also undertake a scan to identify potential gaps in infection prevention and control practices. (Target completion date: Spring 2016)
- The Public Health Agency of Canada, Health Canada, the Canadian Food Inspection Agency and Agriculture and Agri-food Canada will undertake a series of consultations to take stock of existing practices relating to AMU, identify best practices for responsible AMU, and explore how to best leverage existing education opportunities. (Target completion date: Spring 2016)
- Health Canada and the Canadian Food Inspection Agency will work with drug sponsors to facilitate submissions for label changes to remove growth promotion claims of medically important antimicrobial drugs and associated references in the *Compendium of Medicating Ingredient Brochures*. (Target completion date: Fall 2016)
- Health Canada, the Canadian Food Inspection Agency and Agriculture and Agri-food Canada will convene multilateral discussions with F/P/T partners and stakeholders to review and refine proposals for increasing veterinary oversight for veterinary antimicrobials for food animal production. (Target completion date: Spring and Summer 2015)
- The Canadian Institutes of Health Research will support research and dissemination of results regarding research on stewardship measures. (Target completion date: December 2019)

Action 3: Work with the animal agriculture sector partners to strengthen the regulatory framework on veterinary medicines and medicated feeds, including facilitating access to alternatives, and encourage the adoption of practices in order to reduce the use of antimicrobials.

In addition to efforts to improve infection prevention and control measures, as well as promote education and awareness, the Government of Canada has an important role in the regulation of animal health products in Canada, including the importation, licensing, and sale of veterinary drugs, medicated feeds, and vaccines. In support of this role, the following activities will be undertaken:

- Health Canada and the Canadian Food Inspection Agency will continue to prioritize the modernization of the regulatory frameworks for veterinary medicines and medicated feeds. (Target completion date for AMR-related initiatives: December 2016)
- Agriculture and Agri-food Canada will support industry-led research to validate the efficacy of commercially available alternatives to in-feed antibiotics when appropriate. (Target completion date: Summer 2015)

- Health Canada will implement measures to address own-use importation of veterinary drugs, and strengthen the control over the importation of veterinary active pharmaceutical ingredients. (Target completion date: 2017)

- The Canadian Institutes of Health Research will support research at the interface between human and animal health and the environment as part of the Environments and Health Signature Initiative. (Target completion date: Spring 2020)

Innovation

Action 4: Promote innovation through funding collaborative research and development efforts on antimicrobial resistance both domestically and internationally.

As outlined in the Federal Framework, the Government of Canada supports ongoing domestic health research and innovation while collaborating with international partners to contribute to global research efforts on AMR, AMU, novel therapies and alternatives. Some of the key activities in this area will include:

- Through a Canadian Action Plan on Vaccine Research, Innovation and Development, innovative vaccines under development are being prioritized to address some of the most significant threats posed by antimicrobial resistance. (Target completion date: 2015)

- Agriculture and Agri-food Canada will continue to support and/or undertake research and innovation on improvements in animal production practices, disease prevention and treatment, and development of vaccines, which will contribute to reducing the requirements for antimicrobials in the animal production industry. (Ongoing)

- The Canadian Institutes of Health Research will continue to build knowledge to create innovative tools and alternative therapies to prevent and limit the spread of AMR through research and development via both open competition and strategic funding through partnerships, and in particular collaboration with international groups to promote and leverage Canadian contributions within international research teams. (Ongoing)

Moving forward

The Government of Canada remains committed to taking action on AMR and AMU. As such, we will continue to work with federal, provincial, territorial, and international health and agriculture partners, as well as other stakeholders, to identify how we can strengthen existing and planned activities. We will also continue to work to identify new activities to help combat the spread of AMR. The Federal Action Plan is the first in a series to keep Canadians informed of our activities and our ongoing progress in implementing the Federal Framework.

Acknowledgements

Many thanks to all collaborators at the Public Health Agency of Canada, Health Canada, the Canadian Food Inspection Agency, the Canadian Institutes of Health Research, Agriculture and Agri-Food Canada, Industry Canada, and National Research Council Canada.

Conflict of interest

None

References

(1) Public Health Agency of Canada. Antimicrobial Resistance and Use in Canada: A Federal Framework for Action. 2014 Oct 24. http://healthycanadians.gc.ca/drugs-products-medicaments-produits/antibiotic-resistance-antibiotique/antimicrobial-framework-cadre-antimicrobiens-eng.php

(2) Public Health Agency of Canada. Federal Action Plan on Antimicrobial Resistance and Use in Canada: Building on the Federal Framework for Action. 2015 Mar 31. http://healthycanadians.gc.ca/publications/drugs-products-medicaments-produits/antibiotic-resistance-antibiotique/action-plan-daction-eng.php

ID News: Innovation to address antimicrobial resistance

Ling LL, Schneider T, Peoples AJ, Spoering AJ, Engels I, Conlon BP, et al. **A new antibiotic kills pathogens without detectable resistance.** Nature. 2015;517:455–9. doi:10.1038/nature14098
http://www.nature.com/nature/journal/vaop/ncurrent/full/nature14303.html

Antibiotic resistance is spreading faster than the introduction of new compounds into clinical practice, causing a public health crisis. Most antibiotics were produced by screening soil microorganisms, but this limited resource of cultivable bacteria was overmined by the 1960s. Synthetic approaches to produce antibiotics have been unable to replace this platform. Uncultured bacteria make up approximately 99% of all species in external environments, and are an untapped source of new antibiotics. We developed several methods to grow uncultured organisms by cultivation in situ or by using specific growth factors. Here we report a new antibiotic that we term teixobactin, discovered in a screen of uncultured bacteria. Teixobactin inhibits cell wall synthesis by binding to a highly conserved motif of lipid II (precursor of peptidoglycan) and lipid III (precursor of cell wall teichoic acid). We did not obtain any mutants of *Staphylococcus aureus* or *Mycobacterium tuberculosis* resistant to teixobactin. The properties of this compound suggest a path towards developing antibiotics that are likely to avoid development of resistance.

Arias CA, Murray BE. **A new antibiotic and the evolution of resistance.** New Engl JMed. 2015;372:1168–70.
http://www.nejm.org/doi/full/10.1056/NEJMcibr1500292

The emergence of antibiotic resistance threatens our ability to care for patients and is among the top public health threats of the 21st century, yet producing new antibiotics has been a daunting task. Against this bleak landscape, a recent report by Ling et al. brought a ray of light. The authors, using the isolation chip (iChip) were able to culture microorganisms from soil that had not been cultured in vitro previously. The myriad tiny agar-filled chambers of the iChip were seeded with dilutions of soil containing approximately one bacterium per chamber and were then covered with a semipermeable membrane and placed back into the soil, permitting nutrients to diffuse into the chambers. Teixobactin appears to act by forming a complex with precursors of peptidoglycan and teichoic acids of the cell wall of gram-positive bacteria. This work represents a notable advance for the discovery of antibiotics that target gram-positive bacteria and *M. tuberculosis*. (However) if history has taught us any lesson about resistance, it is that the lack of selection of resistance to teixobactin in vitro should be viewed with great caution. Similar claims were made about vancomycin. For now, though, we must take advantage of this expanded pool of testable organisms.